Performance Indicator Ranking and Predictive Modelling in Rugby Union.

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Abstract **ii**

The aim of this study is to increase the body of knowledge surrounding Northern Hemisphere rugby union by establishing norms for performance indicators; forming a ranking of performance indicators in terms of their importance to successful team performance on a game by game and seasonal basis; in addition creating a predictive model that can forecast domestic league success. Match statistics from 132 men's domestic matches played over the 2014/15 season of the Aviva Premiership were analysed. Team performance indicators representing frequencies of a given event for each team in each match were divided into six categories: attack, defence, kicking, breakdown, set pieces and discipline. Statistics from each of the 132 matches were then inputted into Microsoft Excel and subsequently IBM SPSS Statistics for Windows (version 22) software for statistical analysis. The performance indicators were used to highlight key differences between winning and losing performances as well as team ranking on a game by game and seasonal basis. It was found that in accordance to previous research, clean breaks are crucial to successful rugby performance as they often lead to some form of score, and scoring often reflects game outcome (Hughes et al., 2012). Also the need for penalty limitation and effective set pieces, to maintain possession and limit the scoring opportunities of the opposition, (Askew, 2010; Higham, 2014; Hughes et al., 2012) has been supported. Finally, a significant ($P<0.05$) relationship between successful rugby union performance and the amount of mauls won was found, it has been theorized that this was due to the effectiveness of a specific set piece tactic known as lineout drives.

Keywords: Rugby Union; Performance Indicators; Clean Breaks; Mauls

Declaration **iii**

This work is original and has not been previously submitted in support of a Degree, qualification or other course.

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Abbreviations

MLR: Multiple Linear Regression

KPI: Key Performance Indicator

Definitions

Gain Line: An imaginary line that is drawn through the middle of the set piece/breakdown width wise dividing the field into two separate regions; advancing beyond this line is seen as progress towards the opposition goal line (Hendricks, 2013).

Clean Break: Gain line crossed by attacker successfully evading contact (Hendricks, 2013).

1. Introduction

A performance indicator is defined as a selection or combination of action variables that aim to define some or all aspects of performance (Hughes & Bartlett, 2002). However to be truly useful performance indicators should relate to successful performance or outcome, as well as following the three basic rules highlighted by Hughes and Bartlett (2002) when applying them to sport: success or failure must relative to the opposition or previous performances, objective interpretations require aggregated data of a group of teams at an appropriate standard, and finally distributions of actions must be normalised with respect to the total distribution of actions across the area. As well as defining performance, performance indicators can be used to build predictive models that can quantify relationships between dependent and independent variables (Wang et al., 2013).

Performance indicators are applicable to a wide variety of sports which can be classified into three main categories (Hughes & Bartlett, 2002; Read & Edwards, 1992), net and wall games (table tennis, tennis, badminton, volleyball, squash and fives), invasion games (netball, basketball, handball, lacrosse, rugby league, rugby union, hockey and soccer), and striking and fielding games (cricket, baseball, softball and rounders). Peters and O'Donoghue (2013) have also highlighted the uses of performance indicators within team games such as gaelic football, racket sports and finally individual sports such as boxing, show jumping, golf, trampolining and rhythmic gymnastics.

In rugby, Hughes and Bartlett (2002) have categorised performance indicators that affect successful outcome into eight elements these being: passing, tackling, tries, time in possession, field position, set pieces and other.

Previous studies have investigated both team (Kraak & Welman, 2014; Higham et al., 2014; van Rooyen et al., 2006; Jones et al., 2004) and individual (Hughes et al., 2012; James et al., 2005; Cupples & O'Connor, 2011) performance indicators in rugby.

Higham et al. (2014) investigated 196 games of 2011/12 rugby sevens series and attempted to find the effect that changes or differences in performance indicators had on points scoring and the probability of winning within and between teams in Rugby 7's. It was concluded that tactics that increase likelihood of scoring and success should focus on ball possession, fewer breakdowns, turnovers, penalties, free kicks and limited passing.

Van Rooyen et al. (2006) performed a comparisons study between the performances of South Africa, England, Australia and New Zealand during the 2003 Rugby Union World Cup, over a total of 26 games; it was found that superior performance in this tournament was linked to possession retained, points scored in the second half and the likelihood of losing possession in dangerous areas.

Jones et al. (2004) observed twenty matches from a domestic professional male rugby union team's season; Jones et al. (2004) attempted to find differences in performance indicator values between winning and losing performances, as well as developing a methodology to construct team performance profiles through the utilisation of a comprehensive list of performance indicators. It was concluded that only two out of twenty-two performance indicators (lineout success on opposition ball & tries scored) were significantly different, however subtle differences were also found.

The most prestigious achievement in domestic rugby union is winning the top league; this is where teams representing the elite rugby playing cities in the country compete every year to be named the champions of that season, as well as receiving possible royalties and qualification for European competitions (Jones et al., 2004). Therefore a challenge for all teams is to identify the indicators that contribute to the success of winning teams, as this will inform coaches and allow for the development of training programs, interventions and tactics that will maximise these factors and consequently increase the probability of success in the sport (van Rooyen et al., 2006).

Identifying performance indicators that are relevant to successful outcome, particularly with respect to the execution of skills, would allow player and squad selection to become more objective, and also inform the consideration of players during transfer windows (Hughes et al., 2012). Hughes et al. (2012) concluded that simple frequency data, although informative, cannot be used on its own to explain rugby as it is a complex dynamic interactive team sport.

Predictive modelling uses large volumes of data to discover hidden relationships and uses those insights to confidently predict the outcome of future events and interactions. It also enables decision-makers such as coaches and support staff to develop a deeper understanding of sporting performance, in turn allowing them to solve even complex challenges surrounding performance improvement (IBM, 2015).

Predictive modelling has been used in sports such as basketball (Cattelan et al., 2013), rugby (Pledger & Morton, 2011; Lee, 1999) and soccer (Cattelan et al., 2013; Beck & Meyer, 2012). Previous models have looked at

home advantage in rugby union and its impact on tries (converted and unconverted), penalties and drop goals (Pledger & Morton, 2011), simulating seasons to determine whether luck plays a role in a team's final league standing (Lee, 1999) in rugby league, and modelling the outcomes of basketball and soccer contests, allowing for time varying abilities (Cattelan et al.,2013).

In addition, Beck and Meyer (2012) attempted to model whether football teams successes increase with the degree of homogeneity of sociodemographic factors among team members, as well as whether a football teams successes do not change when new defence systems are applied. More recently, Higham et al. (2014) used generalised linear modelling to estimate the effect of an increase in a performance indicator value on a team's probability of winning in international rugby 7's.

As the literature suggests predictive modelling has several practical applications as it can inform a team on where to invest effort for the biggest performance increases (Choppin & Allen, 2012), Jones et al. (2004) has supported this by stating that future research should attempt to create a model of team performance to further enhance team profiles.

Therefore, due to the current lack of literature surrounding domestic rugby union in the northern hemisphere, in addition to the need to rank performance indicators in terms of their link to success and lastly the need to create predictive models to further inform the coaching process; the aim of this study is to establish norms for performance indicators, form a ranking of performance indicators in terms of their importance to successful team performance on a game by game and seasonal basis, in addition to creating a

predictive model that can forecast domestic league success using performance indicators.

2. Methods

2.1 *Sample*

Match statistics from 132 men's domestic matches played over the 2014/15 seasons of the Aviva Premiership were analysed. Match data was retrieved from the official Aviva Premiership Rugby website (http://www.premiershiprugby.com). Team performance indicators representing totals of a given event for each team in each match were divided into six categories: attack, defence, kicking, breakdown, set pieces and discipline (Table 1). Team performance indicators were compared by grouping data into four categories: top ranked teams (T), bottom ranked teams (B), wins (W) and losses (L). This study was approved by the Faculty of Applied Sciences Research Ethics Committee (Appendix 2).

2.2 *Performance Indicators*

Attack performance indicators described how a team achieved offensively with the ball in hand during possession. Defence performance indicators described a team's efforts of preventing opposition scores. Kicking performance indicators described the ability of a team to strike the ball in both open play and point scoring opportunities. Breakdown performance indicators described a team's capacity to retain or win possession of the ball during collapses in open play. Set piece performance indicators described the incidence and result of lineouts and scrums by a team on their ball. Discipline performance indicators described the frequency of law violations and punishments for any given team. Appendix 3 shows the operational definitions

of all performance indicators.

Table 1. Aviva Premiership team performance indicators

Classification	Team Performance Indicators
Attack	Tries, Metres, Carries, Defenders beaten, Clean breaks, Passes, Offloads and Turnovers conceded
Defence	Tackles, Missed tackles and Turnovers Won
Kicking	Kicks in play, Conversions, Penalty goals and Drop goals
Breakdown	Rucks won, Rucks lost, Rucks won (%) and Mauls won.
Set Plays	Lineouts won, Lineouts lost, Lineouts won (%), Scrums won, Scrums lost and Scrums won (%)
Discipline	Penalties conceded, Red cards and Yellow cards

2.3 *System Reliability*

To ensure that the collected match statistics had acceptable reliability the performance of a selected team during a match in the Aviva Premiership was analysed retrospectively by two MSc level performance analysts who had previous experience in rugby union, using a digital analysis software programme (LongoMatch version 0.20.8).

The match was observed and coded in the software's tagging panel. The tagging panel was created by the lead analyst using a pre-defined structure based upon the team indicators used by the official Aviva Premiership Rugby website.

The reliability tests used were similar to those seen by Jones et al (2004). Firstly, intra-observer reliability was established by selecting a match for the lead analyst to code twice over a four-week period under the same conditions, the percentage error was then be calculated for all variables of the match by comparing the output of the repeated trials. As each variable was within an acceptable error (<10%) inter-observer reliability testing commenced.

Inter-observer reliability was then verified by comparing the analysts' outputs from the match with that of the official Aviva Premiership Rugby website. Again the percentage error was calculated for all variables from the match, with the acceptable levels of accuracy being set at <10% error.

All variables were found to have acceptable intra-observer percentage error; however Turnovers Conceded, Turnovers Won and Kicks in Play were all found to have an unacceptable inter-observer percentage error (28.6%, 38.5% and 21.4%, respectively) and therefore were classified as unreliable and omitted from this study (Appendix 4).

2.4 *Statistical Analyses*

Once the reliability of the match statistics sourced from the official Aviva Premiership Rugby website had been verified, and the potentially unreliable performance indicators had been omitted, the researcher then imported the statistics from each of the 132 matches into Microsoft Excel and subsequently IBM SPSS Statistics for Windows (version 22) software for statistical analysis.

2.4.1 *Quartiles and Medians of Performance Indicators*

The 4 different types of performance (TvT, TvB, BvT and BvB) were entered into Microsoft Excel so that the quartiles from 0% to 100% could be determined for each performance indicator for each type of performance (Carroll, 2013).

The data was then entered into IBM SPSS Statistics for Windows (version 22) so that inferential statistical tests could be performed to compare the different types of performance; alike to Carroll (2013) the TvB and BvT

performances in matches, where the teams played each other, were compared using a series of Wilcoxon tests; recognising that these performances were related (Table 2). The performances of the remaining pairs of types were analysed, similarly to Carroll (2013), by comparing a series of Mann Whitney U tests as the performances compared in each test came from different sets of matches (Table 3).

2.4.2 *Ranking Performance Indicators by game*

The data was entered into IBM SPSS Statistics for Windows (version 22) so that inferential statistical tests could be performed to compare the different types of performance; the winning and losing performances in matches where the teams played each other were compared using a series of Wilcoxon tests, recognising that these performances were related (Table 2). The indicators were then ordered by level of significant difference ($P < 0.05$) from highest to lowest.

2.4.3 *Ranking Performance Indicators by season*

The match data was then used to create a seasonal performance profile for all the teams over the 2014/15 season (van Rooyen et al., 2006).

Subsequently, the selected performance indicators acted as the independent variables, with the dependent variable being success in the league, this was defined as whether a team finished in the top or bottom half of the table in the respective season, or not. Each seasonal performance profile was then separated into two groups (either a top 6 or bottom 6) depending on where they finished in the league. As with ranking by game, comparisons between the two groups were then made using IBM SPSS Statistics for

Windows (version 22) software, using a series of Independent Samples t-tests as the performances compared in each test came from different sets of matches. The indicators were then subsequently ordered by level of significant difference ($P < 0.05$) from highest to lowest.

2.4.4 *Modelling Seasonal Points Total*

A multiple linear regression will be performed using the IBM SPSS Statistics for Windows (version 22) software.

Each of the seasonal performance profiles used when ranking by season then had its corresponding seasonal points total added to the data set, the independent variable was once again the selected performance indicators, with the dependent becoming seasonal point total.

As the dependent variable (seasonal points total) can be measured on a continuous scale (ratio) and there is more than two independent variables (performance indicators) that are also continuous (ratio), the data meets the two of the assumptions required for a multiple linear regression. However it must also be assumed that the data does not show multicollinearity.

Therefore a forced enter MLR was performed to create several models that predict seasonal points total containing only the performance indicators that are essential. The most accurate of the models will then be chosen based upon their R^2 value and reported in the results.

3. Results

3.1 *Quartiles and Medians of Performance Indicators*

Table 2 highlights several significant differences in performance between top and bottom teams when competing against each other. As expected, KPI's related to point scoring such as tries scored, conversions attempted and converted as well as penalties attempted and converted were all found to be significantly in favour of the top teams. The set piece has also proved to be an area that differs between the two sets of teams, with the top teams losing significantly less scrums, as well as having a significantly higher lineout and scrum success percentage. Lastly, it has been found that the top teams achieve significantly more clean breaks and concede significantly less penalties compared to their lower level counterparts.

Table 2. Median Values for Different Types of Performances

Performance Indicator	T v B (n=72)		B v T (n=72)		Wilcoxon Test
	Median	IQR	Median	IQR	
Tries	3	3	2	2	$p < 0.05$
Carries	102.5	33.75	96.5	30.25	$p = .777$
Defenders Beaten	17.5	11.25	16	10.25	$p = .174$
Clean Breaks	7	8	5	5.25	$p < 0.05$
Passes	127	41.25	123.5	47	$p = .886$
Offloads	8	8	9	5	$p = .793$
Tackles	100.5	32.75	98.5	37.25	$p = .686$
Missed Tackles	16	10.25	17.5	11.5	$p = .180$
Successful Conversions	3	3	1	1	$p < 0.05$
Attempted Conversions	3	3	2	2	$p < 0.05$
Successful Penalty Goals	2.5	3	2	2	$p < 0.05$
Attempted Penalty Goals	3	2.25	2.5	3	$p < 0.05$
Successful Drop Goals	0	0	0	0	$p = .705$
Attempted Drop Goals	0	0	0	0	$p = .108$
Rucks Won	66	22.5	67.5	21.5	$p = .580$
Rucks Lost	3	2	3.5	3	$p = .832$
Rucks Won (%)	96	4.01	95	3.24	$p = .682$
Mauls Won	0	5	0	4	$p = .258$
Lineouts Won	13	5.25	11	5	$p = .079$
Lineouts Lost	1.5	1.25	2	2	$p = .138$
Lineouts Won (%)	90	12.5	85	12.66	$p < 0.05$
Scrums Won	6	3	5	3	$p = .691$
Scrums Lost	1	1.25	1	2.25	$p < 0.05$

Scrums Won (%)	86	20.56	83	33.33	$p < 0.05$
Penalties Conceded	9.5	4	12	4.25	$p < 0.05$
Red Cards	0	0	0	0	$p = .157$
Yellow Cards	0	1	1	1	$p = .121$

Table 3 shows that the quality of opposition affected top and bottom teams differently. On average top teams achieved significantly more clean breaks, scored significantly more tries, and consequently attempted and converted significantly more conversions; when performing against bottom teams, compared to top teams. However, it was also found that top teams won significantly less turnovers and mauls, and received significantly less red cards against bottom teams than against top teams.

Bottom teams also achieved significantly more clean breaks against lower level opposition. Furthermore bottom teams attempted significantly more drop goals and conceded significantly less penalties when performing against other bottom teams, compared to the top teams.

Table 4. Quartiles for the Performance Indicators of All Four Different Classifications of Performances, Grouped Together.

Performance Indicator	0%	25%	50%	75%	100%
Tries	0	1	2	3	11
Carries	44	86	101	117.25	191
Defenders Beaten	2	12	17	22	43
Clean Breaks	0	4	6.5	9	24
Passes	44	100.75	123.50	151.25	248
Offloads	0	6	9	12	25
Tackles	39	86.75	101.50	124	214
Missed Tackles	2	12	17	22	43
Successful Conversions	0	1	2	3	10
Attempted Conversions	0	1	2	3	11
Successful Penalty Goals	0	1	2	3	9
Attempted Penalty Goals	0	2	3	4	9
Successful Drop Goals	0	0	0	0	1

Attempted Drop Goals	0	0	0	0	3
Rucks Won	25	57	67	83	134
Rucks Lost	0	2	3	5	8
Rucks Won (%)	86.27	93.44	95.12	96.83	100
Mauls Won	0	0	0	5	12
Lineouts Won	1	9	12	14	24
Lineouts Lost	0	1	2	3	8
Lineouts Won (%)	33.33	80	87.50	93.33	100
Scrums Won	1	4	5	7	15
Scrums Lost	0	0	1	2	6
Scrums Won (%)	33.33	75	85.71	100	100
Penalties Conceded	3	9	11	13	23
Red Cards	0	0	0	0	1
Yellow Cards	0	0	0	1	3

Table 4 shows the quartiles of performance indicators regardless of opposition strength. Likewise, Table 5 shows the quartiles of performance indicators, however the results are also broken into categories accounting for the quality of both teams.

Table 3. Median Values for Different Types of Performances, Including Opposition Effects.

Performance Indicator	Top 6 Teams					Bottom 6 Teams				
	T v T (n=60)		T v B (n=72)		MWU	B v T (n=72)		B v B (n=60)		MWU
	Median	IQR	Median	IQR	Test	Median	IQR	Median	IQR	Test
Tries	2	2	3	3	p < 0.05	2	2	2	2.25	p = .073
Carries	96.5	27.75	102.5	33.75	p = .542	96.5	30.25	105	36.25	p = .176
Defenders Beaten	17	10.25	17.5	11.25	p = .372	16	10.25	16	9.25	p = .702
Clean Breaks	6.5	4.5	7	8	p < 0.05	5	5.25	7	5	p < 0.05
Passes	115.5	53.5	127	41.25	p = .370	123.5	47	127	56	p = .260
Offloads	8	5.25	8	8	p = .277	9	5	9	6	p = .662
Tackles	101.5	31.25	100.5	32.75	p = .756	98.5	37.25	106.5	34	p = .101
Missed Tackles	17	10.25	16	10.25	p = .594	17.5	11.5	16	9.25	p = .308
Successful Conversions	1	1.25	3	3	p < 0.05	1	1	1	1	p = .472
Attempted Conversions	2	2	3	3	p < 0.05	2	2	2	2.25	p = .073
Successful Penalty Goals	3	3	2.5	3	p = .636	2	2	2	2	p = .625
Attempted Penalty Goals	3	3	3	2.25	p = .314	2.5	3	3	3	p = .509
Successful Drop Goals	0	0	0	0	p = .804	0	0	0	0	p = .065
Attempted Drop Goals	0	0	0	0	p = .088	0	0	0	0	p < 0.05
Rucks Won	66	25.75	66	22.5	p = .708	67.5	21.5	72	27.25	p = .293
Rucks Lost	3	3	3	2	p = .486	3.5	3	3.5	2	p = .115
Rucks Won (%)	95	3.39	96	4.01	p = .877	95	3.24	95	2.87	p = .240
Mauls Won	4	3	0	5	p < 0.05	0	4	0	2	p = .052
Lineouts Won	12	4.25	13	5.25	p = .460	11	5	11.5	4.25	p = .909
Lineouts Lost	1.5	1	1.5	1.25	p = .918	2	2	2	2	p = .485
Lineouts Won (%)	88	12.28	90	12.5	p = .739	85	12.66	86	14.82	p = .550
Scrums Won	5	3	6	3	p = .625	5	3	5	3	p = .647
Scrums Lost	1	1	1	1.25	p = .645	1	2.25	1	2	p = .081
Scrums Won (%)	83	22.92	86	20.56	p = .406	83	33.33	86	20.56	p = .139
Penalties Conceded	10	4.25	9.5	4	p = .065	12	4.25	11	3.25	p < 0.05
Red Cards	0	0	0	0	p < 0.05	0	0	0	0	p = .507
Yellow Cards	0	1	0	1	p = .860	1	1	0	1	p = .336

Table 5. Quartiles for the Performance Indicators for All Four Performance Types, by Game Type.

Performance Indicator	**Quartile**				
	0%	25%	50%	75%	100%
T v T (n=60)					
Tries	0	1	2	3	7
Carries	54	84	96.50	111.75	177
Defenders Beaten	2	11.75	17	22	34
Clean Breaks	0	3.75	6.50	8.25	19
Passes	56	97	115.50	150.50	229
Offloads	0	4.75	8	10	21
Tackles	50	90	101.50	121.25	172
Missed Tackles	2	11.75	17	22	34
Successful Conversions	0	0.75	1	2	4
Attempted Conversions	0	1	2	3	7
Successful Penalty Goals	0	1	3	4	9
Attempted Penalty Goals	0	2	3	5	9
Successful Drop Goals	0	0	0	0	1
Attempted Drop Goals	0	0	0	0	3
Rucks Won	35	56.75	66	82.50	122
Rucks Lost	0	2	3	5	7
Rucks Won (%)	89.74	93.59	95.12	96.98	100
Mauls Won	0	3	4	6	12
Lineouts Won	3	9.75	12	14	21
Lineouts Lost	0	1	1.5	2	5
Lineouts Won (%)	64.29	81.25	87.50	93.53	100
Scrums Won	1	4	5	7	15
Scrums Lost	0	0	1	1	6
Scrums Won (%)	50	77.08	83.33	100	100
Penalties Conceded	3	8.75	10	13	18
Red Cards	0	0	0	0	1
Yellow Cards	0	0	0	1	3
T v B (n=72)					
Tries	0	2	3	5	11
Carries	44	84.50	102.50	118.25	161
Defenders Beaten	4	13	17.50	24.25	38
Clean Breaks	0	5	7	13	24
Passes	49	104.75	127	146	226
Offloads	1	5	8	13	21
Tackles	39	86.50	100.50	119.25	182
Missed Tackles	3	11	16	21.25	43

Successful Conversions	0	1	3	4	10
Attempted Conversions	0	2	3	5	11
Successful Penalty Goals	0	1	2.50	4	8
Attempted Penalty Goals	0	2	3	4.25	9
Successful Drop Goals	0	0	0	0	1
Attempted Drop Goals	0	0	0	0	2
Rucks Won	30	56.50	66	79	114
Rucks Lost	1	2	3	4	8
Rucks Won (%)	86.27	93.00	95.68	97.00	98.97
Mauls Won	0	0	0	5	12
Lineouts Won	5	9.75	13	15	22
Lineouts Lost	0	1	1.50	2.25	6
Lineouts Won (%)	60	81.25	90	93.75	100
Scrums Won	1	4	6	7	11
Scrums Lost	0	0	1	1.25	3
Scrums Won (%)	33.33	79.44	85.71	100	100
Penalties Conceded	4	8	9.50	12	17
Red Cards	0	0	0	0	0
Yellow Cards	0	0	0	1	3
B v T (n=72)					
Tries	0	1	2	3	5
Carries	46	86	96.50	116.25	170
Defenders Beaten	3	11	16	21.25	43
Clean Breaks	0	3	5	8.25	14
Passes	44	99	123.50	146	225
Offloads	2	7	9	12	25
Tackles	42	84.75	98.50	122	170
Missed Tackles	4	12.75	17.50	24.25	38
Successful Conversions	0	1	1	2	4
Attempted Conversions	0	1	2	3	5
Successful Penalty Goals	0	1	2	3	5
Attempted Penalty Goals	0	1	2.50	4	7
Successful Drop Goals	0	0	0	0	1
Attempted Drop Goals	0	0	0	0	1
Rucks Won	25	56.50	67.50	78	133
Rucks Lost	0	2	3.50	5	7
Rucks Won (%)	87.27	93.71	95.18	96.95	100
Mauls Won	0	0	0	4	10
Lineouts Won	5	9	11	14	24
Lineouts Lost	0	1	2	3	8
Lineouts Won (%)	38.46	79.64	84.41	92.31	100
Scrums Won	2	4	5	7	11
Scrums Lost	0	0	1	2.25	5

Scrums Won (%)	33.33	66.67	82.58	100	100
Penalties Conceded	6	10	12	14.25	23
Red Cards	0	0	0	0	1
Yellow Cards	0	0	1	1	3

B v B (n=60)					
Tries	0	1	2	3.25	8
Carries	65	88.75	105	125	191
Defenders Beaten	2	12	16	21.25	33
Clean Breaks	1	4	7	9	18
Passes	69	108	127	164	248
Offloads	2	7	9	13	22
Tackles	41	93.50	106.50	127.50	214
Missed Tackles	2	12	16	21.25	33
Successful Conversions	0	1	1	2	7
Attempted Conversions	0	1	2	3.25	8
Successful Penalty Goals	0	1	2	3	6
Attempted Penalty Goals	0	1	3	4	9
Successful Drop Goals	0	0	0	0	0
Attempted Drop Goals	0	0	0	0	1
Rucks Won	31	59.75	72	87	134
Rucks Lost	1	3	3.50	5	8
Rucks Won (%)	89.29	93.39	94.81	96.26	99.26
Mauls Won	0	0	0	2	10
Lineouts Won	1	9	11.50	13.25	18
Lineouts Lost	0	1	2	3	8
Lineouts Won (%)	33.33	78.16	85.71	92.98	100
Scrums Won	2	4	5	7	15
Scrums Lost	0	0	1	2	2
Scrums Won (%)	50	79.44	85.71	100	100
Penalties Conceded	6	9	11	12.25	19
Red Cards	0	0	0	0	1
Yellow Cards	0	0	0	1	3

Table 6. Game by Game Performance Indicator Rankings

Rank	Performance Indicator	Win (n=128)		Loss (n=128)		Wilcoxon Test
		Median	IQR	Median	IQR	
1	Tries	3	3	2	1.25	p < 0.05
-	Successful Conversions	2	3	1	2	p < 0.05
-	Attempted Conversions	3	3	2	1.25	p < 0.05
4	Penalties Conceded	10	4	12	4	p < 0.05
5	Successful Penalty Goals	3	3	2	2	p < 0.05
6	Attempted Penalty Goals	3	3	2	2	p < 0.05
7	Scrums Won	6	4	5	4	p < 0.05
8	Clean Breaks	7	5.25	5	6	p < 0.05
9	Yellow Cards	0	1	1	1	p < 0.05
10	Attempted Drop Goals	0	0	0	0	p < 0.05
11	Successful Drop Goals	0	0	0	0	p < 0.05
12	Lineouts Won (%)	88	11.93	86	14.17	p < 0.05
13	Lineouts Lost	2	1	2	2	p < 0.05
14	Scrums Won (%)	86	20.56	83	28.57	p < 0.05
15	Passes	119	44	129.5	54.25	p = .069
16	Rucks Lost	3	2	4	2	p = .085
17	Tackles	104.5	39.25	101	36	p = .120
18	Scrums Lost	1	2	1	2	p = .146
19	Offloads	8	5	9.5	7	p = .197
20	Rucks Won	67	21.5	69	28.25	p = .230
21	Rucks Won (%)	95	2.76	95	3.76	p = .235
22	Mauls Won	0	5	0	4	p = .317
23	Defenders Beaten	18	10.25	16	10	p = .325
24	Missed Tackles	16	10	18	10.25	p = .330
25	Lineouts Won	12	5	11.5	5	p = .471
26	Red Cards	0	0	0	0	p = .705
27	Carries	102	30	100	35.5	p = .724

3.2 *Ranking Performance Indicators by Game and Season*

Table 6 and 7 show that the key performances indicators related to successful game by game performance differ from those related to successful seasonal performance. It was found that teams who were successful game by game and/or over a season conceded fewer penalties (penalties conceded), scored and attempted more conversions (successful conversion and attempted conversions) and scored more tries. Teams that were successful (top 6 teams) over a season also won significantly more mauls (mauls won) than the unsuccessful teams (bottom 6 teams). Finally, teams that were successful game by game attempted and scored more penalty goals (attempted penalty goals and successful penalty goals), won more scrums (scrums won), broke the line more often (clean breaks), conceded less yellow cards, attempted and scored more drop goals (attempted drop goals and successful drop goals), had a higher lineout and scrum efficiency (lineouts won % and scrum won %) and lost less lineouts (lineouts lost), than unsuccessful teams.

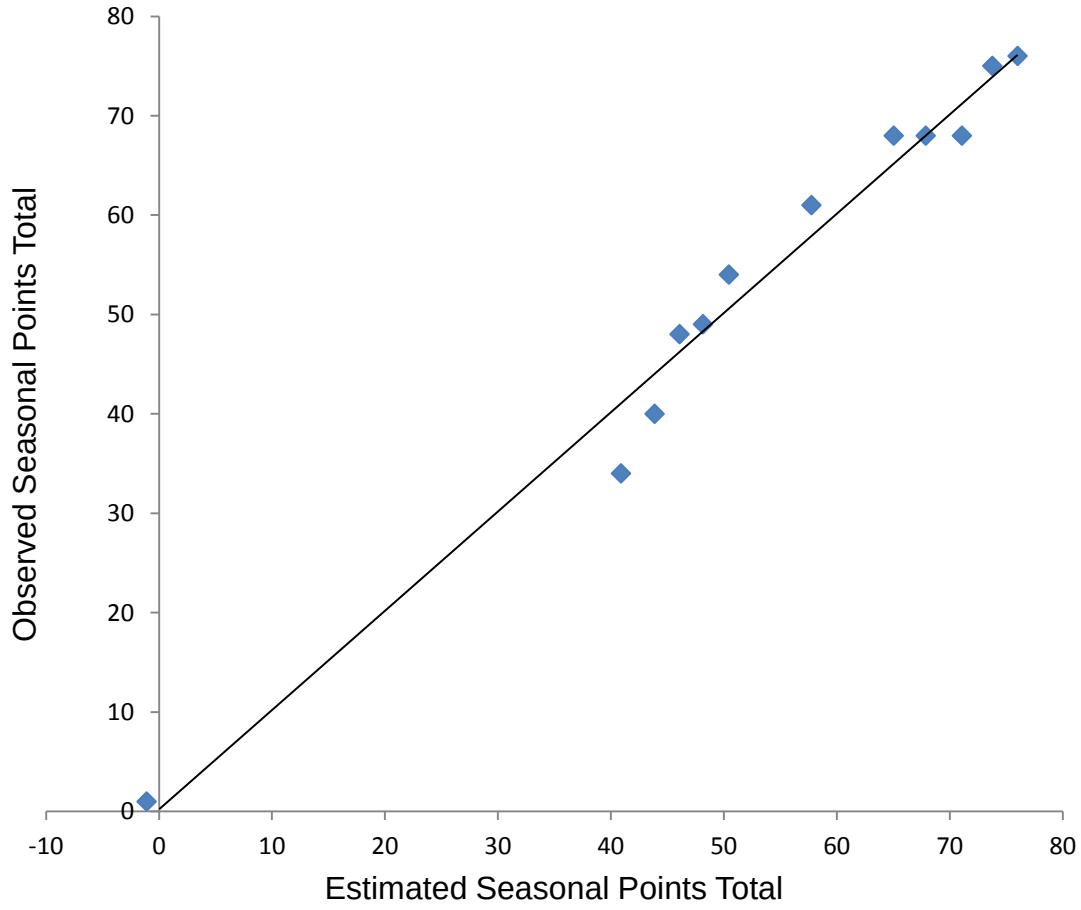
Table 7. Seasonal Performance Indicator Ranking

Rank	**Performance Indicator**	**Top 6 Teams**		**Bottom 6 Teams**		**t Test**
		Mean	**SD**	**Mean**	**SD**	
1	Penalties Conceded	10.31	0.66	11.72	0.80	$p < 0.05$
2	Successful Conversions	2.27	0.61	1.49	0.33	$p < 0.05$
3	Mauls Won	3.36	1.05	1.9	0.82	$p < 0.05$
4	Tries	3.04	0.68	2.21	0.53	$p < 0.05$
-	Attempted Conversions	3.04	0.68	2.21	0.53	$p < 0.05$
6	Successful Penalty Goals	2.73	0.48	1.94	0.87	$p = .081$
7	Scrums Lost	0.97	0.15	1.25	0.39	$p = .151$
8	Lineouts Won	12.15	0.96	11.3	0.95	$p = .157$
9	Clean Breaks	7.63	1.46	6.55	1.17	$p = .184$
10	Attempted Penalty Goals	3.4	0.58	2.69	1.15	$p = .205$
11	Lineouts Won (%)	87.67	3.81	84.5	4.35	$p = .212$
12	Scrums Won (%)	85.17	4.38	82.33	7.26	$p = .240$
13	Offloads	8.71	1.70	9.8	1.41	$p = .251$

14	Lineouts Lost	1.73	0.58	2.12	0.61	p = .275
15	Yellow Cards	0.51	0.14	0.64	0.24	p = .283
16	Passes	123.95	11.79	132.35	14.74	p = .301
17	Rucks Lost	3.46	0.32	3.67	0.36	p = .305
18	Rucks Won	68.42	4.46	72.27	8.77	p = .360
19	Carries	101.24	4.73	104.91	10.14	p = .440
20	Attempted Drop Goals	0.16	0.09	0.12	0.07	p = .443
21	Missed Tackles	17.1	2.44	18.07	3.59	p = .596
22	Defenders Beaten	18.02	3.09	14.15	3.09	p = .634
23	Rucks Won (%)	95.17	0.55	95	0.60	p = .687
24	Red Cards	0.03	0.04	0.04	0.03	p = .698
25	Successful Drop Goals	0.04	0.03	0.03	0.02	p = .713
26	Tackles	105.63	4.21	106.43	13.79	p = .894

3.3 *Modelling Seasonal Points Total*

Figure 1. Model to predict Seasonal Points Total



A multiple linear regression was calculated to predict seasonal points total based on twenty-seven performance indicators. A significant regression

equation was found ($F(8,3) = 16.455$, $p < 0.05$), with an R^2 of 0.978 and standard error of 6.109. Teams' seasonal points total is equal to -532.305 + 14.754 (Penalties Conceded) + 21.774 (Successful Conversions) + 42.206 (Successful Penalty Goals) - 12.398 (Scrums Lost) + 27.492 (Lineouts Won) – 12.205 (Clean Breaks) + 0.762 (Offloads) + 28.421 (Lineouts Lost), where the performance indicators are measured as an average frequency. Penalties conceded, successful conversions, successful penalty goals, lineouts won and lineouts lost were significant predictors of seasonal points total.

4. Discussion

4.1 *Quartiles and Medians of Performance Indicators*

Table 4 allows elite English rugby union teams to compare their performances to the entire population. As mentioned by Carroll (2013) despite the table not taking into account opposition quality, which is possibly a key contributor to performance, these results give coaches and players a point of reference to compare their performances against that of their peers.

Table 5 allows coaches and players to critically analyse their performances in certain games by breaking each performance indicator into quartiles, while also accounting for opposition quality. Carroll (2013) stated the importance of including opposition quality as without these norms coaches and players could misinterpret their performances as being better or worse than what it actually was. If we use rucks lost as an example; the median value for a top team's performance (against a bottom team) is 3, while that frequency for a bottom team (against a top team) would register in the first quartile. Therefore a bottom team would be likely to devalue their performance if they simply

compared their rucks lost to a top team, which could ultimately affect team tactics or preparation (Carroll, 2013).

Table 3 shows that the quality of opposition affected top and bottom teams differently. Askew et al. (2010) has advised that the defensive structures of high-level rugby union teams should focus on restricting the space needed for ball carriers to avoid any contact with the defence, as well as committing greater than one defender to a tackle to increase the difficultly for ball carriers to successfully offload the ball; as these are characteristics of line-breaks and as a result promote opposition try scoring capability. It can therefore be suggested that the defensive structures of the bottom teams are not as adept in these areas when compared to top teams, thus potentially explaining why they concede more line breaks against both top and bottom teams.

As Hughes et al. (2012) stated the ultimate aim of the game is point scoring in matches due to its strong relationship with game outcome, and owing to line breaks often leading to tries or some other form of score it is an area where high-level rugby union teams should focus there attacking structure. Therefore, the majority of teams now focus their attacking efforts on avoiding contact out wide, as this is where defensive lines are more vulnerable and as a result, the gain line is more frequently crossed (Hendricks, 2013). Therefore, coaches and support staff should now encourage attacking players to attempt evasive manoeuvres such as side-stepping and crossover stepping regardless of running lines; as utilizing an evasive manoeuvre to avoid contact is likely to put the defender in a weak position, resulting in a poor and ineffective attempted tackle. As a consequence, this allows the attacker to break the tackle or free his arms to offload the ball, therefore increasing the likelihood of line

breaks and points scoring (Hendricks, 2013). This may also offer an alternative explanation as to why bottom teams concede more line breaks and why top teams score more points. Nevertheless it must be noted that attacking wide does increase the risk of the defensive side winning the breakdown and so may in part explain why top teams do not conceded significantly more points than their opposition, as they might exploit this weakness (Hendricks, 2013).

The lineout drive may offer some explanation as to why top teams win a significantly higher frequency of mauls when playing other top teams as opposed to the bottom teams. Lineout drives are a common tactic employed against stern opposition that are difficult to break down. The purpose of this tactic is to create a maul directly from an attacking lineout with the goal of gaining territory, manipulating field position and ultimately tying in defenders to create time and space for attackers. It was also found that when top teams compete against each other there is a significantly increased number of sanctions in the form of red cards, Areni (2014) suggests that this may be due to the high stakes of each game, and so teams losing late in a match are more likely to persistently commit transgressions in an attempt to regain possession of the ball.

Bottom teams attempted more drop goals when playing against top teams as opposed to bottom teams; this may be due to their inability to breach top teams effective defensive structure, thereby sacrificing possession that maybe lost in the pursuit of scoring seven points by a try in the order to potentially gain three points via a drop goal. Though the effectiveness of this strategy is up to debate, as it contradicts Higham's (2014) findings that higher possession time has a positive effect on points scoring and chances of winning,

suggesting that successful teams are more patient and have greater control of the game.

It was also found that bottom teams conceded more penalties when playing against top teams as opposed to bottom teams, this may again be due to the high stakes of each game triggering teams losing late on in a match to persistently commit transgressions in an attempt to regain possession of the ball. However conceding penalties and free kicks limits a team's opportunities to score, by giving the opposition territory and possession. As such successful teams utilise the advantage rule to continue play, following an infringement by the opposition (Areni, 2014; Higham, 2014).

4.2 *Ranking Performance Indicators by Game and Season*

Table 6 can be used to inform coaches about the importance of each of the twenty-seven performance indicators in relation to successful game outcome, and therefore allow the development of training programs, interventions and tactics that will maximise these factors and consequently increase the probability of success during a game (van Rooyen et al., 2006).

Table 7 offers coaches an opportunity to grasp a deeper understanding of each of the twenty-seven performance indicators in relation to successful seasonal outcome, therefore facilitating more long term training programs, playing styles and tactics that will maximise these factors and consequently increase the probability of success during a season (van Rooyen et al., 2006), in addition to objectifying player and squad selection and also informing the consideration of players during transfer windows (Hughes et al., 2012).

Of the twenty-seven performance indicators examined in this study fourteen were found to be significant when comparing winning and losing performances (Table 6). Only five (penalties conceded, successful conversions, mauls won, tries and attempted conversions) of the performance indicators were found to be significant when comparing seasonal success between the top and bottom teams (Table 7).

Unsurprisingly, scoring is fundamental to success in rugby union on both a game by game and seasonal basis, as point scoring has been found to have a strong relationship with outcome, and as previously mentioned higher possession time also has a positive effect on the chances of winning. This suggests that successful teams are more patient and have greater control of the game. This supports the findings that successful teams conceded significantly less penalties and had an effective set piece, as it allowed them to maintain possession and limit the scoring opportunities of the opposition (Askew, 2010; Higham, 2014; Hughes et al., 2012). Again the effectiveness of lineout drives, as previously mentioned, has also been reinforced by the link of successful seasonal performance to mauls won.

4.3 *Modelling Seasonal Points Total*

Figure 1 highlights a predictive model that enables decision-makers such as coaches and support staff to develop a deeper understanding of performance, by informing them of areas to invest effort,t for the biggest performance increases, as well as allowing them to solve complex challenges surrounding seasonal performance improvement (IBM, 2015; Choppin & Allen, 2012).

The model suggests that penalties conceded, successful conversions, successful penalty goals, lineouts won and lineouts lost were all significant predictors of seasonal point total. This coincides with the previous findings of this study surrounding the strong relationship between points scoring and outcome; moreover the number of penalties conceded and effectiveness of set piece dictates how well a team can maintain possession and limit the scoring opportunities of the opposition (Askew, 2010; Higham, 2014; Hughes et al., 2012).

5. Conclusion

5.1 *Summary*

In conclusion, this research agrees with previous literature surrounding the importance of clean breaks to rugby performance, as they often lead to some form of score, with scoring often reflecting game outcome (Hughes et al., 2012). Also the need for penalty limitation and effective set pieces to maintain possession and limit the scoring opportunities of the opposition (Askew, 2010; Higham, 2014; Hughes et al., 2012) has been supported. Without a doubt, the most novel finding of this study is the link between successful rugby union performance and mauls won potentially due to the effectiveness of lineout drives.

5.2 *Future Research*

Future research should now focus on addressing the limitations of this study by investigating the performance indicators excluded due to poor reliability, namely turnovers and kicks in play. There is also scope to further investigate lineout efficiency and tactics, in particular catch and drives; with the

aim of better understanding the links between mauls and successful performance.

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7. Appendices

Appendix 1. Participant Information Sheet

Participant Information Sheet

Indicators of Team Performance and Success in Rugby Union.

You are being invited to take part in a research study. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask me if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

Thank you for reading this.

What is the purpose of the study?
The aim of this study is to establish a ranking of performance indicator's in terms of their importance to successful performances and seasons, secondly this study aims to create a predictive model that can calculate league success using key performance indicators.

Why have I been chosen?
You have been selected to take part in this study as you are an experienced analyst who is currently studying an MSc in performance analysis and has previous experience in analysing rugby union.

Do I have to take part?
It is up to you to decide whether or not to take part. If you decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason. A decision to withdraw at any time, or a decision not to take part, will not affect the standard of care you receive in any way.

What will happen to me if I take part?
This study's research questions will be answered by statistically analysing match statistics from 132 men's domestic matches played over the 2014/15 season of the Aviva Premiership, this match data will be retrieved from the official Aviva Premiership Rugby website (http://www.premiershiprugby.com). Therefore it is essential to the study that the match data used is proven to be reliable.

To ensure that the collected match statistics have acceptable reliability you will be required to retrospectively analyse a total of 2 hours of match footage from a match from the 2014/15 season using a digital analysis software programme (LongoMatch version 0.20.8). Each match will be observed and coded in the software's tagging panel. The tagging panel will be created by the researcher using a pre-defined structure based upon the team indicators used by the official Aviva Premiership Rugby website.

Firstly, you will be asked to demonstrate intra-observer reliability by coding the match twice over a four-week period under the same conditions, your percentage error (acceptable error <5%) will then be calculated for all variables of each match by comparing the output of the repeated trials. You will then be required to analyse the remaining three matches and subsequently inter-observer reliability testing will commence.

Your coded matches will then be used to display inter-observer reliability by comparing your outputs from each of the coded matches with that of the researcher and the official Aviva Premiership Rugby website. Again the percentage error will be calculated for all variables from each match, with the acceptable levels of accuracy being set at <5% error.

Any variable that is found to have an unacceptable intra-observer and/or inter-observer percentage error will be classed as unreliable and omitted from this study.

What are the possible disadvantages and risks of taking part?
As the study requires you to perform analysis on 9 matches in total which equates to 12 hours of footage it can be a time consuming process that requires long periods in front of a computer, therefore it is essential that during analysis you maintain the correct posture and take regular breaks to minimise the risk of back strain and eyestrain.

What are the possible benefits of taking part?
You will gain practical experience that can be used in an applied setting as you will: perform 12 hours of analysis with rugby union footage, be exposed to a wide variety of performance indicators and become familiarised with potentially novel software.

Moreover the findings of this study will offer you a greater understanding of the underlying principles of success on a game by game and seasonal basis in rugby union, this knowledge may prove beneficial to you in future analysis or coaching settings.

What if something goes wrong?
If you wish to complain or have any concerns about any aspect of the way you have been approached or treated during the course of this study, please contact the Dean of the Faculty of Applied and Health Sciences, University of Chester, Parkgate Road, Chester, CH1 4BJ, 01244 513055.

If you are harmed by taking part in this research project, there are no special compensation arrangements. If you are harmed due to someone's negligence (but not otherwise), then you may have grounds for legal action, but you may have to pay for this.

Will my taking part in the study be kept confidential?

All information which is collected by you during the course of the research will be kept strictly confidential so that only the researcher carrying out the research will have access to such information. All data will be coded to ensure anonymity of the analyst.

What will happen to the results of the research study?
The results of this project might be published but any data included will in no way be linked to any specific analyst.

You are most welcome to request a copy of the results of the project should you wish.

The data collected will be securely stored in such a way that only those mentioned above will be able to gain access to it.

Who is organising and funding the research?
The Department of Sport and Exercise Sciences at the University of Chester will be involved in organising and carrying out the study.

Who may I contact for further information?
If you have any questions about the project, either now or in the future, please feel free

to contact Ryan Farrell Green at 1120684@chester.ac.uk.

Appendix 2. Ethics Application Approval Certificate

Faculty of Life Sciences
Research Ethics Committee

frec@chester.ac.uk

10/07/2015

Ryan Green
Henshall Street
Chester

Study title:	**Performance indicator ranking and predictive modelling in Rugby Union**
FREC reference:	**110-15-RFG-SES**
Version number:	**1**

Thank you for sending your application to the Faculty of Life Sciences Research Ethics Committee for review.

I am pleased to confirm ethical approval for the above research, provided that you comply with the conditions set out in the attached document, and adhere to the processes described

in your application form and supporting documentation. However, the Committee would like to make the following recommendations:-

- Provide CV for Thomas Crossley and define his role.
- Complete Appendix page.
- Remove Sarah Andrew's name from PIS and complaints procedure – refer only to job title - 'The Dean'.
- Replace Additional Researcher Information Sheet with standard PIS and provide and invitation letter and Consent Form for study.
- Check all documents for typing, spelling and grammatical errors.

Please forward an electronic copy of all of the amendments to frec@chester.ac.uk

The final list of documents reviewed and approved by the Committee is as follows:

Document	Version	Date
Application Form	1	June 2015
Appendix 1 – List of References	1	June 2015
Appendix 2 – Summary CV for Lead Researcher	1	June 2015
Appendix 3 – Participant Information Sheet [PIS]	1	June 2015

Please note that this approval is given in accordance with the requirements of English law only. For research taking place wholly or partly within other jurisdictions (including Wales, Scotland and Northern Ireland), you should seek further advice from the Committee Chair / Secretary or the Research and Knowledge Transfer Office and may need additional approval from the appropriate agencies in the country (or countries) in which the research will take place.

With the Committee's best wishes for the success of this project.

Yours sincerely,

Dr. Stephen Fallows
Chair, Faculty Research Ethics Committee

Enclosures: Standard conditions of approval.

Cc. Supervisor/FREC Representative

Appendix 3. Operational Definitions (IRB, 2015; Hendricks, 2013)

Action	Definition
Try	Attacking player first to ground the ball in the opposition' in-goal area.
Carry	Attacking player attempts to gain territory while in possession of the ball.
Defenders Beaten	Gain line crossed by an attacker penetrating the attempted tackle.
Clean Break	Gain line crossed by attacker successfully evading contact.
Pass	Attacking player attempts to give possession of the ball to another member of their team.
Offload	Gain line crossed by attacker successfully passing in the contact situation.
Tackle	A tackle occurs when the ball carrier is held by one or more opponents and is brought to the ground.
Missed Tackle	A tackle is missed when an attacking player evades or penetrates the attempted tackle.
Conversion	After a try is scored the player's team has the right to score a goal by taking a kicking at goal.
Conversion Outcome	
Successful	Kick lands between the uprights of the goal.
Attempted	Attempted conversion kick.
Penalty Goal	A player can attempt to score by taking a kick at goal following the opposition conceding penalty.
Penalty Goal Outcome	
Successful	Kick lands between the uprights of the goal.
Attempted	Attempted penalty kick.
Drop Goal	A player can score a drop goal by kicking a goal between the uprights from a drop kick in general play,
Drop Goal Outcome	
Successful	Kick lands between the uprights of the goal.
Attempted	Attempted drop goal.
Ruck	Occurs when one or more players from each team, who are on their feet, in physical contact, close around the ball on the ground.
Ruck Outcome	
Won	Attacking team successfully retain possession of the ball from a ruck.
Lost	Attacking team failed to retain possession of the ball from a ruck.
Win %	The total number on rucks won divided by the total number of rucks (Rucks Won and Rucks Lost).
Maul	Occurs when a player carrying the ball is held by one or more opponents, and one or more of the ball carriers team mates bind onto the ball carrier.
Maul Outcome	

Won	Attacking team successfully retain possession of the ball from a maul.
Lineout	Occurs when a contact arises immediately after the player in possession makes contacts the ground after jumping to contest for possession.
Lineout Outcome	
Won	Attacking team successfully retain possession of the ball from a lineout.
Lost	Attacking team failed to retain possession of the ball from a lineout.
Win %	The total number on lineouts won divided by the total number of lineouts (Lineouts Won and Lineouts Lost).
Scrum	Occurs when eight players from each team, bind together in three rows for each team and close up so that the head of the front rows are interlocked.
Scrum Outcome	
Won	Attacking team successfully retain possession of the ball from a scrum.
Lost	Attacking team failed to retain possession of the ball from a scrum.
Won %	The total number on scrums won divided by the total number of scrums (Scrums Won and Scrums Lost).
Penalties Conceded	When a team is sanctioned with a penalty due to foul play.
Red Cards	When a player has been sent off from the field of play.
Yellow Cards	When a player has been cautioned and temporarily suspended from play.

Appendix 4. Reliability Testing

	Intra Reliabiliy				
	1st	2nd	Min	Max	% Error
Tries	2	2	0	11	0.0
Carries	110	110	44	191	0.0
Defenders Beaten	21	21	2	43	0.0
Clean Breaks	9	9	0	24	0.0
Passes	160	160	44	248	0.0
Offloads	16	16	0	25	0.0
Turnovers Conceded	11	9	3	24	9.5
Tackles	43	45	39	214	-1.1
Missed Tackles	20	22	2	43	-4.9
Turnovers Won	11	10	0	13	7.7
Kicks in Play	29	31	7	49	-4.8
Successful Conversions	1	1	0	10	0.0
Attempted Conversions	2	2	0	11	0.0
Conversion (%)	50.0%	50.0%	0.0%	100.0%	0.0
Successful Penalty Goals	3	3	0	9	0.0
Attempted Penalty Goals	3	3	0	9	0.0
Penalty Goals (%)	100.0%	100.0%	0.0%	100.0%	0.0
Successful Drop Goals	0	0	0	1	0.0
Attempted Drop Goals	0	0	0	3	0.0
Drop Goals (%)			0.0%	100.0%	0.0
Rucks Won	81	81	25	134	0.0
Rucks Lost	5	5	0	8	0.0
Rucks Won (%)	94.2%	94.2%	86.3%	100.0%	0.0
Mauls Won	9	9	0	12	0.0
Lineouts Won	20	20	1	24	0.0
Lineouts Lost	1	1	0	8	0.0
Lineouts Won (%)	95.2%	95.2%	33.3%	100.0%	0.0
Scrums Won	5	5	1	15	0.0
Scrums Lost	1	1	0	6	0.0
Scrums Won (%)	83.3%	83.3%	33.3%	100.0%	0.0
Penalties Conceded	12	12	3	23	0.0
Red Cards	1	1	0	1	0.0
Yellow Cards	0	0	0	3	0.0

	Inter Reliability				
	RFG	TC	Min	Max	% Error
Tries	2	2	0	11	0.0
Carries	110	112	44	191	-1.4
Defenders Beaten	21	17	2	43	9.8
Clean Breaks	9	8	0	24	4.2
Passes	160	140	44	248	9.8
Offloads	16	16	0	25	0.0
Turnovers Conceded	9	13	3	24	-19.0
Tackles	45	43	39	214	1.1
Missed Tackles	22	18	2	43	9.8
Turnovers Won	10	5	0	13	38.5
Kicks in Play	31	37	7	49	-14.3
Successful Conversions	1	1	0	10	0.0
Attempted Conversions	2	2	0	11	0.0
Conversion (%)	50.0%	50.0%	0.0%	100.0%	0.0
Successful Penalty Goals	3	3	0	9	0.0
Attempted Penalty Goals	3	3	0	9	0.0
Penalty Goals (%)	100%	100.0%	0.0%	100.0%	0.0
Successful Drop Goals	0	0	0	1	0.0
Attempted Drop Goals	0	0	0	3	0.0
Drop Goals (%)			0.0%	100.0%	0.0
Rucks Won	81	77	25	134	3.7
Rucks Lost	5	5	0	8	0.0
Rucks Won (%)	94.2%	93.9%	86.3%	100.0%	2.1
Mauls Won	9	9	0	12	0.0
Lineouts Won	20	19	1	24	4.3
Lineouts Lost	1	1	0	8	0.0
Lineouts Won (%)	95.2%	95.0%	33.3%	100.0%	0.4
Scrums Won	5	5	1	15	0.0
Scrums Lost	1	1	0	6	0.0
Scrums Won (%)	83.3%	83.3%	33.3%	100.0%	0.0
Penalties Conceded	12	12	3	23	0.0
Red Cards	1	1	0	1	0.0
Yellow Cards	0	0	0	3	0.0

	Inter Reliability				
	RFG	Report	Min	Max	% Error
Tries	2	2	0	11	0.0
Carries	110	115	44	191	-3.4
Defenders Beaten	21	18	2	43	7.3
Clean Breaks	9	9	0	24	0.0
Passes	160	156	44	248	2.0
Offloads	16	16	0	25	0.0
Turnovers Conceded	9	15	3	24	-28.6
Tackles	45	54	39	214	-5.1
Missed Tackles	22	20	2	43	4.9
Turnovers Won	10	5	0	13	38.5
Kicks in Play	31	22	7	49	21.4
Successful Conversions	1	1	0	10	0.0
Attempted Conversions	2	2	0	11	0.0
Conversion (%)	50.0%	50.0%	0.0%	100.0%	0.0
Successful Penalty Goals	3	3	0	9	0.0
Attempted Penalty Goals	3	3	0	9	0.0
Penalty Goals (%)	100.0%	100.0%	0.0%	100.0%	0.0
Successful Drop Goals	0	0	0	1	0.0
Attempted Drop Goals	0	0	0	3	0.0
Drop Goals (%)			0.0%	100.0%	0.0
Rucks Won	81	75	25	134	5.5
Rucks Lost	5	5	0	8	0.0
Rucks Won (%)	94.2%	93.8%	86.3%	100.0%	3.2
Mauls Won	9	10	0	12	-8.3
Lineouts Won	20	20	1	24	0.0
Lineouts Lost	1	1	0	8	0.0
Lineouts Won (%)	95.2%	95.2%	33.3%	100.0%	0.0
Scrums Won	5	5	1	15	0.0
Scrums Lost	1	1	0	6	0.0
Scrums Won (%)	83.3%	83.3%	33.3%	100.0%	0.0
Penalties Conceded	12	11	3	23	5.0
Red Cards	1	1	0	1	0.0
Yellow Cards	0	0	0	3	0.0